SECTION 13040

ABOVE GROUND STORAGE TANKS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and erect a Factory Mutual Approved glass-fused-to-steel bolted water storage tank for fire suppression use, including foundation, tank structure and tank appurtenances as shown on the drawings. All required labor, materials and equipment shall be included.

B. Tank and all appurtenances shall be in accordance with ~~latest NFPA regulations~~ **NFPA 13-2007 and NFPA 22-2003 regulations.**

~~1.02 QUALIFICATIONS OF TANK SUPPLIER~~

~~A. The Engineer's selection of factory applied glass- fused-to-steel bolt together tank construction for this facility has been predicated upon the design criteria, construction methods specified, and optimum coating for resistance to internal and external tank surface corrosion. Deviations from the specified design, construction or coating details, will not be permitted.~~

~~B. The bidder shall offer a new tank structure as supplied from a U.S.A. manufacturer specializing in the design, fabrication and erection of factory applied glass-fused-to-steel, bolt together tank systems. The manufacturer shall own and operate its production plant, fabricate and glass coat the tank at one U.S.A. location.~~

~~C. The tank shown on the contract drawings and specified herein is a model 1715SSWT Aquastore® Tank as manufactured by Engineered Storage Products Company of DeKalb, Illinois.~~

~~D. Alternate glass-fused-to-steel tank products, as provided by other manufacturers, will be considered for prior approval by the Engineer. Manufacturers lacking the experience requirement will not be considered.~~

~~E. Strict adherence to the standards of design; fabrication; erection; product quality; and long term performance, established in this Specification will be required.~~

~~1. Substitutions shall be of reputable manufacturers capable of documenting a record of successful installations of similar equipment as required below. In addition to manufacturer's catalog data sheets, submit:~~
~~a) Typical structure and foundation drawing(s)~~
~~b) List of tank materials, appurtenances and tank coating specifications.~~
~~c) List of five (5) tanks presently in fire suppression water service designed to AWWA D 103 Standard, of equal or greater size and character specified herein, operating satisfactorily for a minimum of five (5) years, including the name and telephone number of Owner and Engineer.~~

1.03 SUBMITTAL DRAWINGS AND SPECIFICATIONS

A. The bidder is required to furnish, for the approval of the Engineer and at no increase in contract price, 6 sets of complete specifications and construction drawings for all work. A complete set of structural calculations shall be provided for the tank structure and foundation. All such submissions shall be stamped by a Registered Professional

Engineer licensed in the state of Virginia.

B. When approved, two sets of such prints and submittal information will be returned to the contractor and these drawings will then govern for the work detailed thereon. The approval by the Engineer of the tank supplier's drawings shall be an approval relating only to their general conformity with the bidding drawings and specifications and shall not guarantee detail dimensions and quantities, which remains the bidder's responsibility.

C. **<u>After the design is reviewed by the Engineer, project inspection shall comply with BCOM DEB Notice 012010 - Delegation of Authority for Storage Tank Systems.</u>**

D. The tank manufacturer's and installing contractor's standard published warranty shall be included with submittal information.

E. The tank manufacturer shall provide the Operation and Maintenance Manual upon receipt of approved drawings.

PART 2 - PRODUCTS

2.01 DESIGN CRITERIA

A. Tank dimensions, capacity and floor elevation shall be as shown on the drawings.

B. Tank Design Standards

1. The materials, design, fabrication and erection of the bolted steel tank shall conform to the AWWA Standard for "Factory-Coated Bolted Steel Tanks For Water Storage" - ANSI/AWWA D103, NPFA 22-2003 and Factory Mutual (FM) specifications for bolted steel pump suction tanks.
2. **<u>Design loads shall comply with NFPA 22-2003.</u>**
3. The tank coating system shall conform solely to Section 10.4 of ANSI/AWWA D103 latest revision.
4. All materials furnished by the tank manufacturer, which are in contact with the stored water shall be certified and listed by the National Sanitation Foundation (NSF) to meet ANSI/NSF Additives Standard No. 61. Certification of a coating type alone will not be sufficient to meet this requirement.

C. Design Loads

1. The tank manufacturer is responsible for the design of the tank and therefore is responsible for selecting the appropriate design loads for the tank. This shall include but not be limited to wind velocity, design freeboard, roof snow load, seismic classification and soil bearing. The contractor will be responsible for obtaining the necessary geotechnical information required for the tank design.

D. Tank Color

1. The tank shall be Forest Green in color.

2.02 MATERIALS SPECIFICATIONS

A. Plates and Sheets

1. Plates and sheets used in the construction of the tank shell and tank roof, shall comply with the minimum standards of AWWA D103.

2. Design requirements for mild strength steel shall be ASTM A1011 Grade 30 with a maximum allowable tensile stress of 14,566 psi per AWWA D103.
3. Design requirements for high strength steel shall be ASTM A1011 Grade 50 with a maximum allowable tensile stress of 26,000 psi.
4. The annealing effect created from the glass coated firing process shall be considered in determining ultimate steel strength. In no event shall a yield strength greater than 50,000 psi be utilized for calculations detailed in AWWA D103, Sections 3.4 and 3.5.
5. When multiple vertical bolt line sheets and plates of ASTM A1011 Grade 50 are used, the effective net section area shall not be taken as greater than 85% of the gross area.

B. Rolled Structural Shapes

1. Material shall conform to minimum standards of ASTM A36 or ASTM A992.

C. Horizontal Wind Stiffeners

1. Design requirements for intermediate horizontal wind stiffeners shall be of the "web truss" type with an extended tail creating multiple layers of stiffener, permitting wind loads to be distributed around the tank.
2. Web truss stiffeners shall be of steel with hot dipped galvanized coating.
3. Rolled steel angle stiffeners are not permitted for use as horizontal wind stiffeners.

D. Bolt Fasteners

1. Bolts used in tank lap joints shall be 1/2" - 13 UNC- 2A rolled thread, and shall meet the minimum requirements of AWWA D103, Section 2.2.
2. Bolt Material
    a) SAE Grade 2 (1” bolt length)
        i. Tensile Strength - 74,000 psi Min.
        ii. Proof Load - 55,000 psi Min.
        iii. Allowable shear stress with threads excluded from the shear plane - 18,163 psi (AWWA D-103).
    b) SAE Grade 5/ASTM A325 (1 1/4" bolt length)
        i. Tensile Strength - 120,000 psi Min.
        ii. Proof Load - 85,000 psi Min.
        iii. Allowable shear stress with threads excluded from the shear plane – 29,454 psi (AWWA D-103).
    c) SAE grade 8/ASTM A490 (>1 1/4" bolt length)
        i. Tensile Strength - 150,000 psi Min.
        ii. Proof Load - 120,000 psi Min.
        iii. Allowable shear stress with threads excluded from the shear plane - 36,818 psi (AWWA D-103).
3. Bolt Finish - Zinc, mechanically deposited.
    a) 2.0 mils minimum - under bolt head, on shank and threads
4. Bolt Head Encapsulation
    a) High impact polypropylene copolymer encapsulation of entire bolt head up to the splines on the shank.
    b) Resin shall be stabilized with an ultraviolet light resistant material such that the color shall appear black.
    c) The bolt head encapsulation shall be certified to meet the ANSI/NSF Standard 61 for indirect additives.
5. All tank shell bolts shall be installed such that the head portion is located inside the tank, and the washer and nut are on the exterior.
6. All lap joint bolts shall be properly selected such that threaded portions will not be exposed in the "shear plane" between tank sheets. Bolt lengths shall be sized as to

achieve a neat and uniform appearance. Excessive threads extending beyond the nut after torquing will not be permitted.

7. All lap joint bolts shall include a minimum of four (4) splines on the underside of the bolt head at the shank in order to resist rotation during torquing.

E. Sealants

1. The lap joint sealant shall be a one component, moisture cured, polyurethane compound. The sealant shall be suitable for contact with potable water and meet applicable FDA Title 21 regulations, as well as, ANSI/NSF Additives Standard 61.
2. The sealant shall be used to seal lap joints and bolt connections and edge fillets for sheet notches and starter sheets. The sealant shall cure to a rubber-like consistency, have excellent adhesion to the glass coating, low shrinkage, and be suitable for interior and exterior use.
3. Sealant curing rate at 73° F and 50% RH
   a) Tack-free time: 6 to 8 hours.
   b) Final cure time: 10 to 12 days.
4. Neoprene gaskets and tape type sealer shall not be used.

2.03 GLASS COATING SPECIFICATION

A. Surface Preparation

1. Following the decoiling and shearing process, sheets shall be steel grit-blasted on both sides to the equivalent of SSPC-10. Sand blasting and chemical pickling of steel sheets is not acceptable.
2. The surface anchor pattern shall be not less than 1.0 mil.
3. These sheets shall be evenly oiled on both sides to protect them from corrosion during fabrication.

B. Preparation of Sheet Edges

1. After initial sheet preparation, all full height vertical wall sheets and all rectangular shaped floor sheets shall be beveled and an ARC deposited coating of a corrosion resistant stainless steel alloy shall be applied to the exposed sheet edges.

C. Cleaning

1. After fabrication and prior to application of the coating system, all sheets shall be thoroughly cleaned by a caustic wash and hot rinse process followed immediately by hot air drying.
2. Inspection of the sheets shall be made for traces of foreign matter or rust. Any such sheets shall be recleaned or grit-blasted to an acceptable level of quality.

D. Coating

1. All side wall sheets shall receive one coat of a glass pre-coat to both sides and then air dried.
2. Another coat of milled cobalt blue glass shall be applied to both sides of the sheets.
3. A third coat of titanium dioxide reinforced white glass shall be applied to all interior sheet surfaces. The specified coating shall be Aquastore Vitrium™.
4. The same glass coating as applied to the exterior sheet surfaces shall be applied to the exposed edges.
5. The sheets shall then be fired at a minimum temperature of 1500° F in strict accordance with the manufacturer's ISO 9001 quality control procedures, including firing time, furnace humidity, temperature control, etc.

6. The minimum glass thickness on the interior of the sheet after firing shall be 10 mils.

E. Inspection

1. The manufacturer's quality system shall be ISO 9001 certified.
2. Coated sheets shall be inspected for mil thickness (Mikrotest or equal).
3. Coated sheets shall be checked for color uniformity by an electronic colorimeter.
4. An electrical leak detection test shall be performed on the inside surface after fabrication of the sheet. Sheets with excessive electrical leakers shall be rejected.

F. Packaging

1. All sheets that pass Factory Inspection and Quality Control checks shall be protected from damage prior to packing for shipment.
2. Heavy paper or plastic foam sheets shall be placed between each panel to eliminate sheet-to-sheet abrasion during shipment.
3. Individual stacks of panels will be wrapped in heavy mil plastic and steel banded to special wood pallets built to maintain the roll-radius of the tank panels and minimize contact or movement of finished panels during shipment.
4. Shipment from the factory will be by truck, hauling the tank components exclusively.

PART 3 - EXECUTION

3.01 ERECTION

A. Foundation

1. The tank foundation is a part of this contract and shall be installed by the tank bidder.
2. The tank foundation shall be designed by the manufacturer to safely sustain the structure and its live loads.
3. Tank footing design shall be based on the soil bearing capacity as determined by geotechnical analysis performed by a licensed soils engineer.

B. Tank Floor

1. The floor design is of reinforced concrete with an embedded glass coated steel starter sheet per the manufacturer's design and in accordance with AWWA D103 latest edition, Sec 11.4.
2. Leveling of the starter ring shall be required and the maximum differential elevation within the ring shall not exceed one-eighth (1/8) inch, nor exceed one-sixteenth (1/16) inch within any ten (10) feet of length.
3. A leveling plate assembly consisting of two anchor rods and a slotted plate shall be used to secure the starter ring, prior to encasement in concrete. Installation of the starter ring on concrete blocks or bricks, using shims for adjustment, is not permitted.
4. Place one butyl rubber elastomer waterstop seal on the inside surface of the starter ring below concrete floor line. Place one bentonite impregnated water seal below the butyl rubber seal. The materials shall be installed in accordance with tank manufacturer's instructions.

C. Sidewall Structure

1. Field erection of the glass-coated, bolted-steel tank shall be in strict accordance with the procedures outlined in the manufacturer's erection manual, and performed by an authorized dealer of the tank manufacturer, regularly engaged in erection of these tanks, using factory trained and certified erectors.

2. Specialized erection jacks and building equipment developed and manufactured by the tank manufacturer shall be used to erect the tanks.
3. Particular care shall be taken in handling and bolting of the tank panels, structural members, and appurtenances to avoid abrasion of the coating system. Prior to a liquid test, all surface areas shall be visually inspected by the Engineer.
4. An electrical leak test shall be performed during erection using a wet sponge nine (9) volt leak detection device. All electrical leak points found on the inside surface shall be repaired in accordance with manufacturer's published touch up procedure.
5. No backfill shall be placed against the tank sidewall without prior written approval of the tank manufacturer. Any backfill allowed shall be placed according to the strict instructions of the tank manufacturer.

D. Roof

1. Tanks shall include a radially sectioned roof fabricated from glass-coated, bolted steel panels, as produced by the tank manufacturer, and shall be assembled in a similar manner as the sidewall panels utilizing the same sealant and bolting techniques, to assure a weather tight assembly. The roof shall be clear-span and self-supporting. Both live and dead loads shall be carried by the tank walls. The roof shall be of a rolled knuckle design, with no rolled angle connection between sidewall and roof panels. The manufacturer shall furnish a roof opening which shall be placed near the outside tank ladder and which shall be provided with a hinged cover and a hasp for locking. The opening shall have a clear dimension of at least twenty-four (24") inches in one direction and fifteen (15") inches in the other direction. The opening shall have a curb at least four (4") inches in height, and the cover shall have a downward overlap of at least two (2") inches, or a gasketed weather-tight cover in lieu of the four (4") inch curb and two (2") inch overlap.
2. Roof Vent
   a) A properly sized vent assembly in accordance with AWWA D103 shall be furnished and installed above the maximum water level of sufficient capacity so that at maximum design rate of water fill or withdrawal, the resulting interior pressure or vacuum will not exceed 0.5" water column.
   b) The overflow pipe shall not be considered to be a tank vent.
   c) The vent shall be constructed of aluminum such that the hood can be unbolted and used as a secondary roof access.
   d) The vent shall be so designed in construction as to prevent the entrance of birds and/or animals by including an expanded aluminum screen (½ inch) opening. An insect screen of 23 to 25 mesh polyester monofilament shall be provided and designed to open should the screen become plugged by ice formation.

E. Appurtenances (per AWWA D103, Section 5)

1. Pipe Connections
   a) Where pipe connections are shown to pass through tank panels, they shall be field located, saw cut, (acetylene torch cutting or welding is not permitted), and utilize an interior and exterior flange assembly. The tank shell reinforcing shall comply with AWWA D103 latest edition. A single component urethane sealer shall be applied on any cut panel edges or bolt connections.
   b) Overflow piping shall be exterior schedule 80 PVC size as indicated on the drawings.
2. Outside Tank Ladder
   a) An outside tank ladder shall be furnished and installed as shown on the submittal drawings.
   b) Ladders shall be fabricated of aluminum and utilize grooved, skid-resistant rungs.
   c) Safety cage and step-off platforms shall be fabricated of galvanized steel. Ladders shall be equipped with a hinged lockable entry device.

3. Sidewall Access Manways
    a) Two bottom access doors shall be provided in accordance with NFPA 22.
    b) The manhole opening shall be a minimum of 24 inches in diameter. The access door (shell manhole) and the tank shell reinforcing shall comply with AWWA D103 latest edition, Sec. 5.1.
4. Identification Plate
    a) A manufacturer's nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be affixed to the tank exterior sidewall at a location approximately five (5) feet from grade elevation in a position of unobstructed view.
5. Cathodic Protection
    a) A passive cathodic protection system shall be designed and supplied by the tank manufacturer.
6. Temperature Monitoring
    a) Two critical water temperature sensors shall be provided to monitor the temperature in the tank in accordance with NFPA 22 and 72. The signals for these sensors shall be connected to the fire pump control panel located in the main building.
7. Level Monitoring
    a) Two critical water level floats shall be provided to monitor the water level in the tank in accordance with NFPA 22 and 72. The signals for these floats shall be connected to the fire pump control panel located in the main building. The floats shall be provided with enough cable to allow them to be adjusted to any level in the tank.
8. Hillside Nozzles
    a) Hillside nozzles shall be used for all small tank penetrations for controls connections.

3.02 FIELD TESTING

A. Hydrostatic

1. Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling tank to its overflow elevation.
2. Any leaks disclosed by this test shall be corrected by the erector in accordance with the manufacturer's recommendations.
3. Water required for testing shall be furnished by the Owner at the time of tank erection completion, and at no charge to the tank erector.
4. Labor and equipment necessary for hydrostatic tank testing is to be included in the price of the tank.

3.03 DISINFECTION

A. Standards

1. The tank structure shall be disinfected at the time of testing by chlorination in accordance with AWWA Standard C652-02 "Disinfection of Water Storage Facilities" as modified by the tank manufacturer.
2. Disinfection shall not take place until tank sealant is fully cured.
3. Acceptable forms of chlorine for disinfection shall be:
    a) Liquid chlorine as specified in AWWA C652-02.
    b) Sodium hypochlorite as specified in AWWA C652-02.
4. Acceptable methods of chlorination shall be:
    a) Chlorination method 1 as outlined in AWWA C652-02 Section 4.3.
    b) Chlorination method 2 as outlined in AWWA C652-02 Section 4.3.
    c) Chlorination method 3 as outlined in AWWA C652-02 Section 4.3.

5. Acceptable application methods shall be:
    a) Chemical feed pump.
    b) Spraying, brushing, or painting of all water-contact surfaces.

3.04 TANK MANUFACTURER'S WARRANTY

A. The tank manufacturer shall include a warranty for the tank materials and coating. As a minimum, this warranty shall provide assurance against defects in material or workmanship and corrosion of the glass coated surface for a period of one (1) year.

END OF SECTION